

NTHS5404T1

Power MOSFET

20 V, 7.2 A, N-Channel ChipFET™

Features

- Low $R_{DS(on)}$ for Higher Efficiency
- Logic Level Gate Drive
- Miniature ChipFET Surface Mount Package Saves Board Space
- Pb-Free Package is Available

Applications

- Power Management in Portable and Battery-Powered Products; i.e., Cellular and Cordless Telephones and PCMCIA Cards

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	5 Secs	Steady State	Unit
Drain-Source Voltage	V_{DS}	20		V
Gate-Source Voltage	V_{GS}	± 12		V
Continuous Drain Current ($T_J = 150^\circ\text{C}$) (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	I_D	7.2	5.2	A
		5.2	3.8	
Pulsed Drain Current	I_{DM}	± 20		A
Continuous Source Current (Diode Conduction) (Note 1)	I_S	7.2	5.2	A
Maximum Power Dissipation (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	P_D	2.5	1.3	W
		1.3	0.7	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150		$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

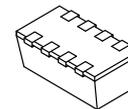
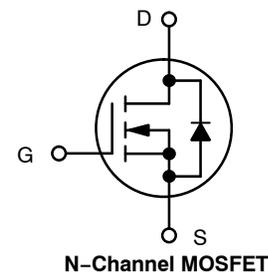
1. Surface Mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).



ON Semiconductor®

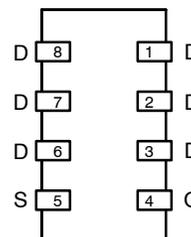
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
20 V	25 m Ω @ 4.5 V	7.2 A

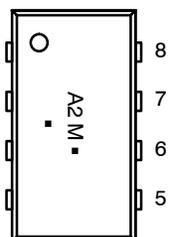


ChipFET
CASE 1206A
STYLE 1

PIN CONNECTIONS



MARKING DIAGRAM



A2 = Specific Device Code
M = Month Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTHS5404T1	ChipFET	3000/Tape & Reel
NTHS5404T1G	ChipFET (Pb-Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NTHS5404T1

THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Junction-to-Ambient (Note 2) $t \leq 5$ sec Steady State	$R_{\theta JA}$	40 80	50 95	$^{\circ}\text{C}/\text{W}$
Maximum Junction-to-Foot (Drain) Steady State	$R_{\theta JF}$	15	20	$^{\circ}\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
----------------	--------	----------------	-----	-----	-----	------

DYNAMIC (Note 4)

Total Gate Charge	Q_G	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.2\text{ A}$		12	18	nC
Gate-Source Charge	Q_{GS}			2.4		
Gate-Drain Charge	Q_{GD}			3.2		
Input Capacitance	C_{ISS}	$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$		740		pF
Output Capacitance	C_{OSS}			337		
Reverse Transfer Capacitance	C_{RSS}			88		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 10\ \Omega, I_D \cong 1.0\text{ A}, V_{GEN} = 4.5\text{ V}, R_G = 6\ \Omega$		8.0	15	ns
Rise Time	t_r			7.0	15	
Turn-Off Delay Time	$t_{d(off)}$			50	60	
Fall Time	t_f			28	40	

STATIC

Drain-to-Source Breakdown Voltage (Note 3)	$V_{(BR)DSS}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	20	25.1		V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			18.4		mV/ $^{\circ}\text{C}$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	0.6			V
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$			1.0	μA
		$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}, T_J = 85^{\circ}\text{C}$			5.0	
On-State Drain Current (Note 3)	$I_{D(on)}$	$V_{DS} \geq 5.0\text{ V}, V_{GS} = 4.5\text{ V}$	20			A
Drain-Source On-State Resistance (Note 3)	$r_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 5.2\text{ A}$		0.025	0.030	Ω
		$V_{GS} = 2.5\text{ V}, I_D = 4.3\text{ A}$		0.038	0.045	
Forward Transconductance (Note 3)	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 5.2\text{ A}$		20		S

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage (Note 3)	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 5.2\text{ A}$		0.8	1.2	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0\text{ V}, I_S = 5.2\text{ A}, di_S/dt = 100\text{ A}/\mu\text{s}$		20.9		ns
Charge Time	t_a			10.2		
Discharge Time	t_b			10.6		
Reverse Recovery Time	Q_{rr}			11		nC

2. Surface Mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
3. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production testing.

TYPICAL ELECTRICAL CHARACTERISTICS

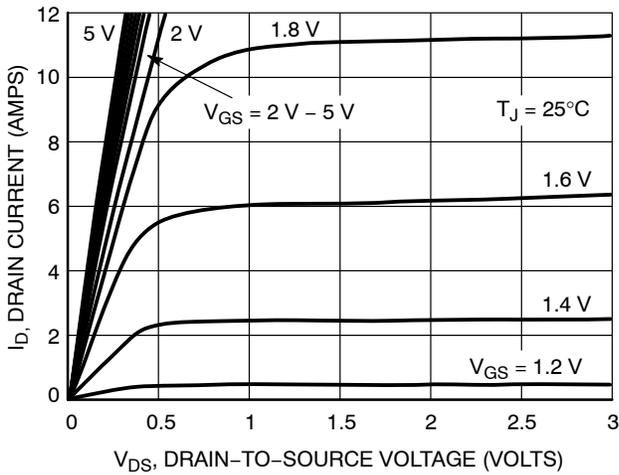


Figure 1. On-Region Characteristics

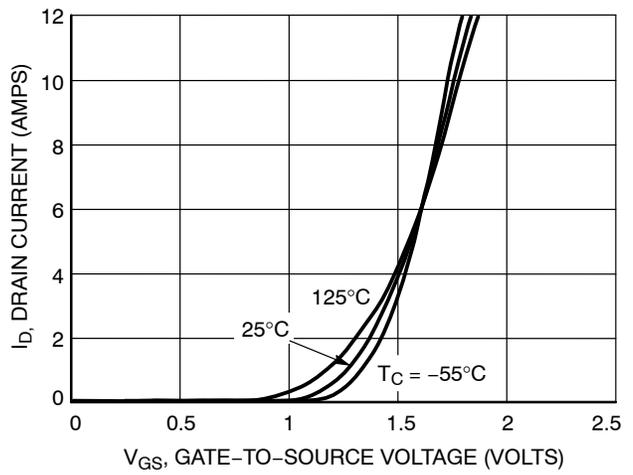


Figure 2. Transfer Characteristics

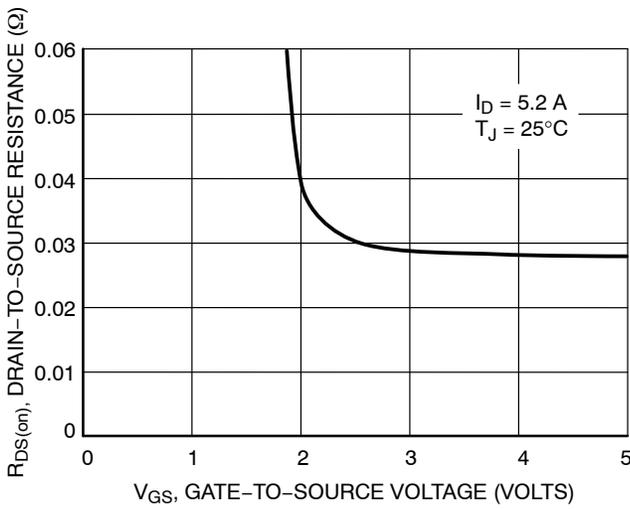


Figure 3. On-Resistance versus Gate-to-Source Voltage

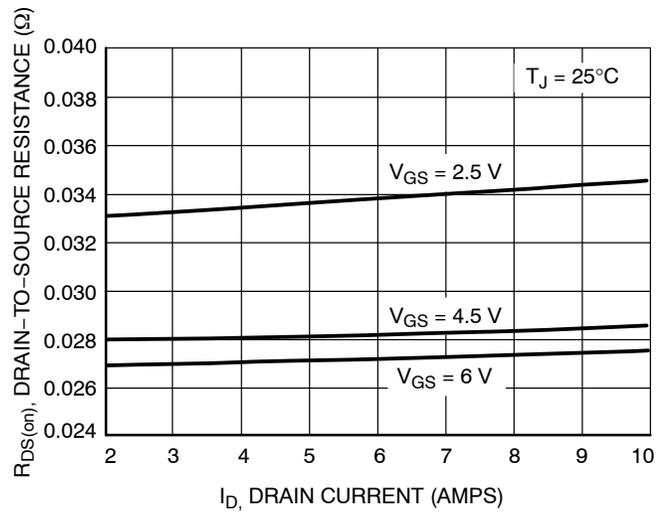


Figure 4. On-Resistance versus Drain Current and Gate Voltage

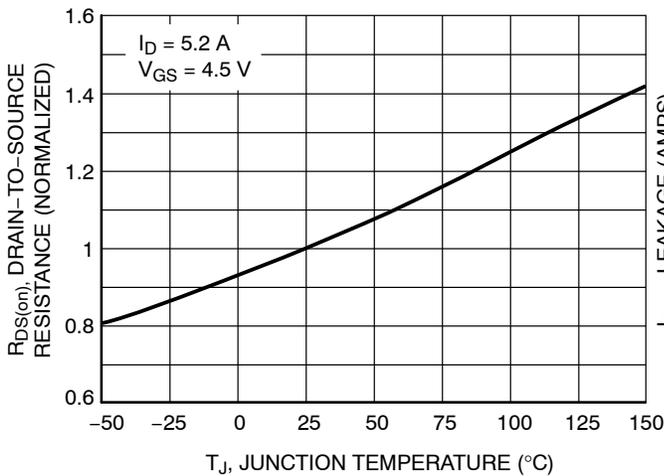


Figure 5. On-Resistance Variation with Temperature

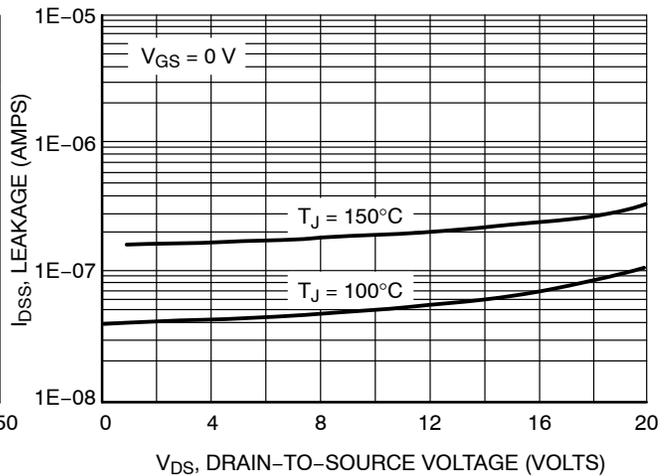


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

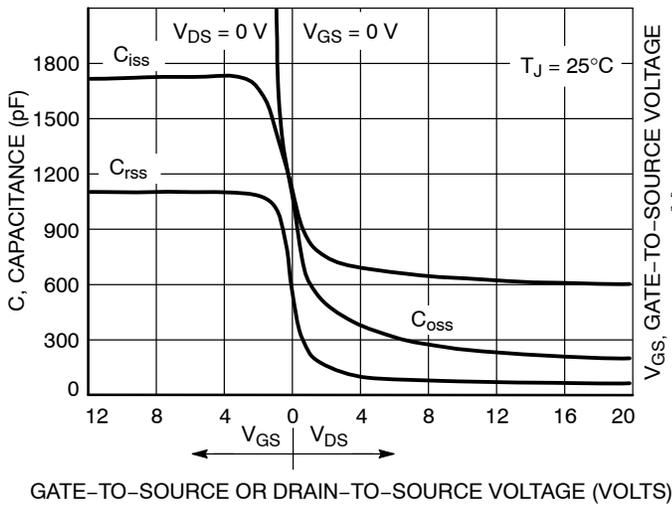


Figure 7. Capacitance Variation

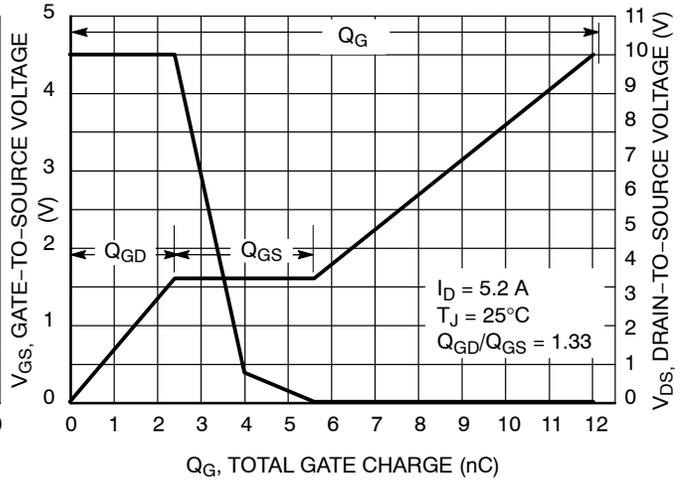


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

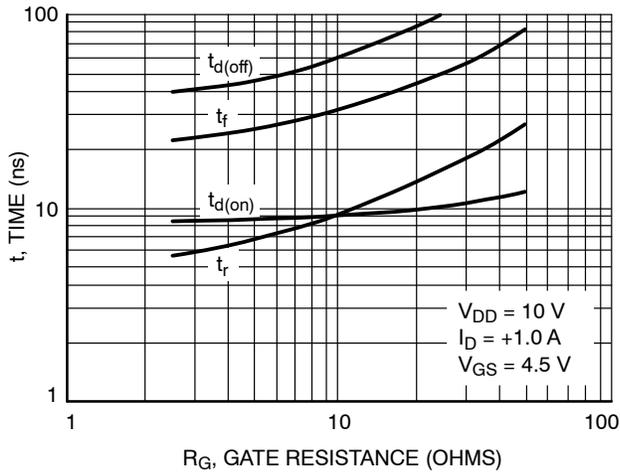


Figure 9. Resistive Switching Time Variation versus Gate Resistance

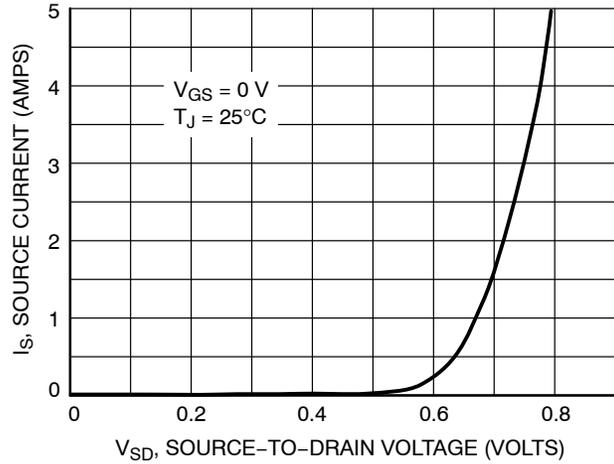


Figure 10. Diode Forward Voltage versus Current

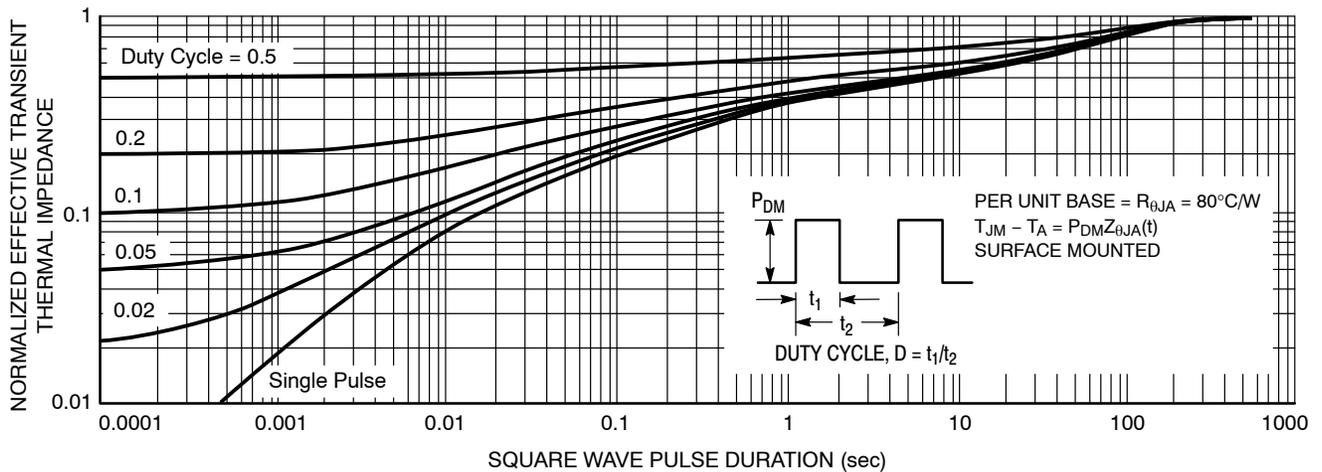


Figure 11. Normalized Thermal Transient Impedance, Junction-to-Ambient

NTHS5404T1

SOLDERING FOOTPRINT*

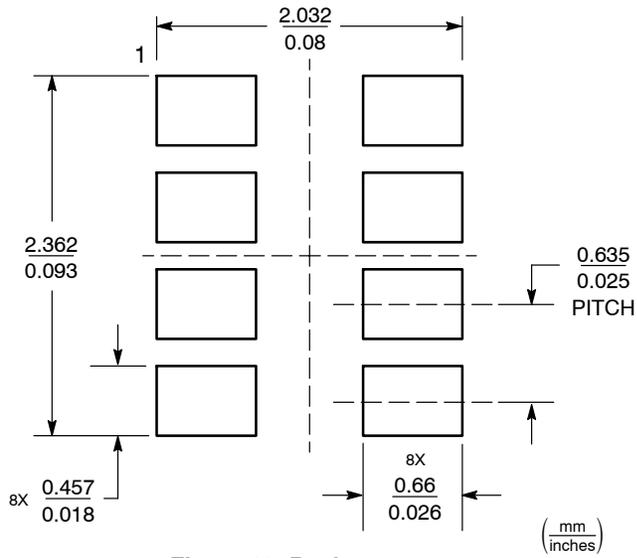


Figure 12. Basic

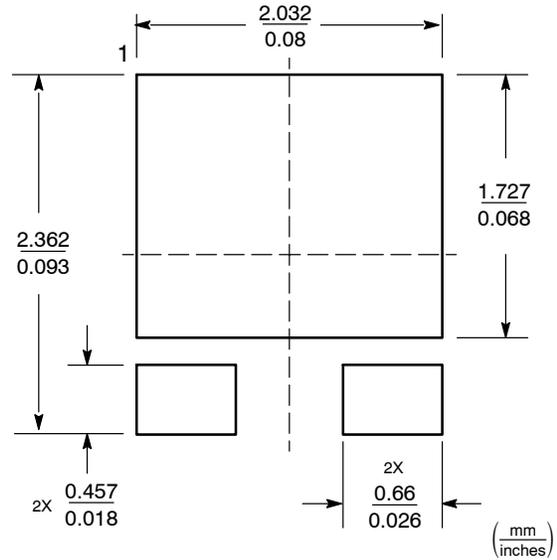
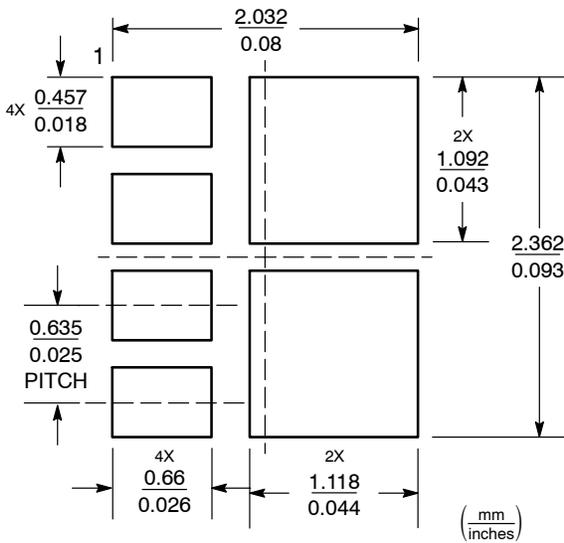
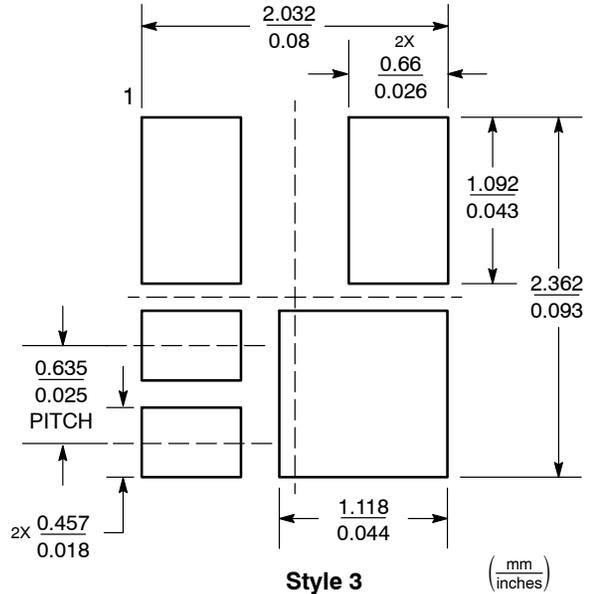


Figure 13. Style 1 and 4

ADDITIONAL SOLDERING FOOTPRINTS*



Style 2



Style 3

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

BASIC PAD PATTERNS

The basic pad layout with dimensions is shown in Figure 12. This is sufficient for low power dissipation MOSFET applications, but power semiconductor performance requires a greater copper pad area, particularly for the drain leads.

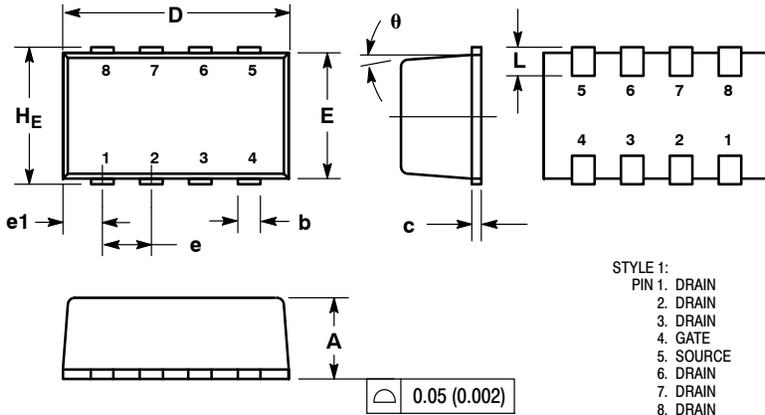
The minimum recommended pad pattern shown in Figure 13 improves the thermal area of the drain connections (pins 1, 2, 3, 6, 7, 8) while remaining within the

confines of the basic footprint. The drain copper area is 0.0054 sq. in. (or 3.51 sq. mm). This will assist the power dissipation path away from the device (through the copper lead-frame) and into the board and exterior chassis (if applicable) for the single device. The addition of a further copper area and/or the addition of vias to other board layers will enhance the performance still further.

NTHS5404T1

PACKAGE DIMENSIONS

ChipFET™
CASE 1206A-03
ISSUE J

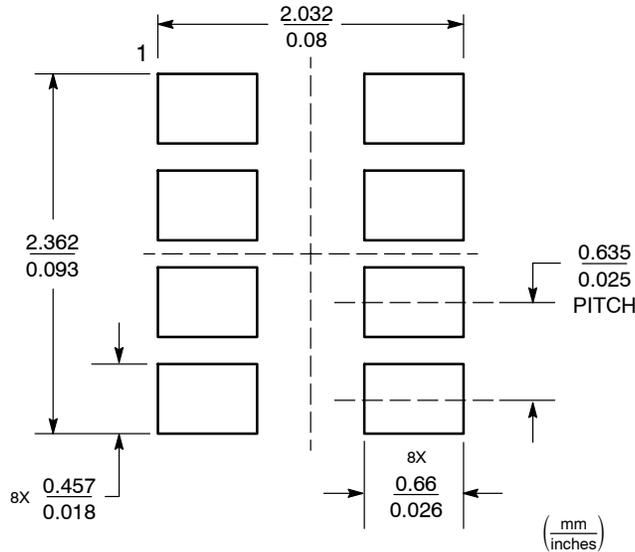


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH ALLOWED ON THE TOP AND BOTTOM LEAD SURFACE.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.00	1.05	1.10	0.039	0.041	0.043
b	0.25	0.30	0.35	0.010	0.012	0.014
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	1.55	1.65	1.70	0.061	0.065	0.067
e	0.65 BSC			0.025 BSC		
e1	0.55 BSC			0.022 BSC		
L	0.28	0.35	0.42	0.011	0.014	0.017
H _E	1.80	1.90	2.00	0.071	0.075	0.079
θ	5° NOM			5° NOM		

SOLDERING FOOTPRINT



Basic Style

ChipFET is a trademark of Vishay Siliconix.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative